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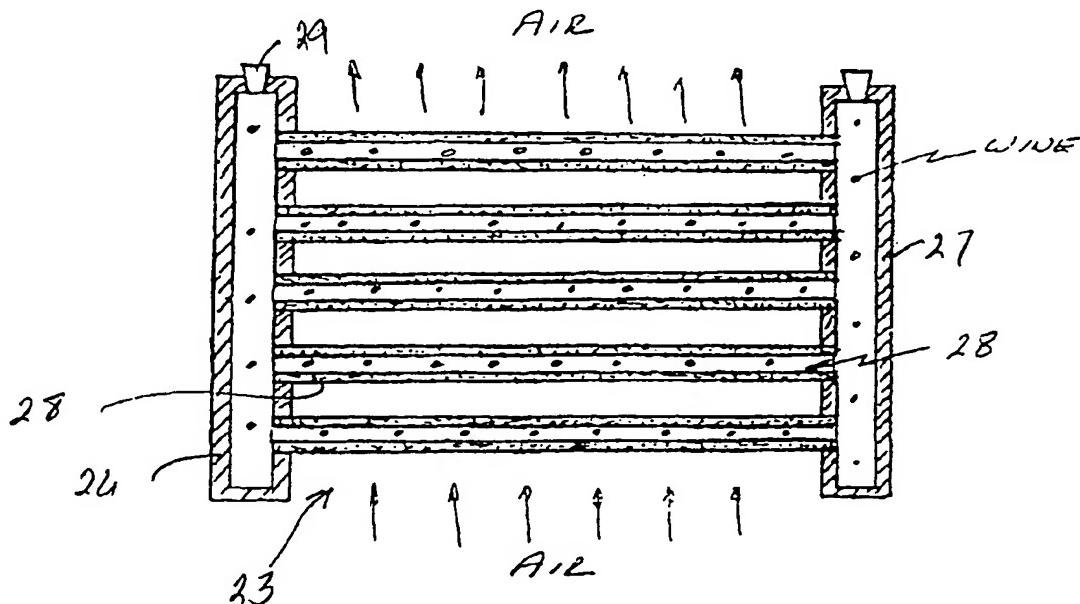
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(54) Title: APPARATUS AND METHOD FOR AGING WINE OR SPIRITS



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(57) Abstract: An apparatus and method for aging wine or spirits is described. The apparatus employs a plurality of spaced hollow semi-permeable tubes (12) which provide an interface wall between the wine or spirits and the atmosphere whereby oxygen can infuse through the walls of the tube into the wine or spirits. In one embodiment, the wine or spirits are in contact with the outer surface of the tubes and the atmosphere with the inner surface. In another embodiment, the wine or spirits are in contact with the inner surface of the tubes and the atmosphere with the outer surface.

**APPARATUS AND METHOD FOR AGING WINE OR SPIRITS****RELATED APPLICATIONS**

[001] This application claims priority to Provisional Application Serial No. 60/327,683 filed October 4, 2001.

**BRIEF DESCRIPTION OF THE INVENTION**

[002] This present invention relates generally to an apparatus and method for aging wine and spirits, and more particularly to an apparatus in which a semi-permeable wall or membrane provides an interface between the wines or spirits and the atmosphere with the interface with the wine or spirits having a substantially larger interface area with the wine or spirits than that of the prior art.

**BACKGROUND OF THE INVENTION**

[003] In the making of many wines and spirits it is usual to mature the wine or spirit in wooden barrels. Barrel aging is a centuries-old practice to improve the characteristics such as taste and mellowness of wine. Usually, for quality wines, the barrels are made of oak. It is felt that the infusion of oxygen through the oak into the wine or spirits is an important aging process. Present understanding suggests that the aging process softens the wine by polymerization of the phenols with the involvement of oxygen. Some flavor is introduced by the oak material but it has not been established that the presence of oxygen at the wine-oak interface enhances the quality of the oak-induced flavoring. The oak flavor, for less expensive wines, may be obtained by introducing oak slabs or chips into the wine, which may be contained in stainless steel tanks.

[004] The prior art which may be considered relevant to the present invention involves the modifications of barrels or containers used for the maturation of wines and spirits. The objects of these modifications are directed to decreasing the cost of the container compared to conventional stave barrel or to reduce the use of high-quality oak which is available in limited supply. An example of prior art may be found in the following patents.

[005] Patent No. 2,108,661 teaches the use of a single hollow wooden plug with very limited area which provides an interface with the wine in a container. The plug is filled with compounds for treating the wine. It is not used for the purpose of providing an interface to the atmosphere.

[006] Patent No. 2,114,009 describes a bored wooden dowel that does not provide a surface for the slow oxidation of wine, but rather is inserted to provide the oak flavor.

separated from the atmosphere by a semi-permeable wall or membrane which has an interface area that is at least 50% greater than that of the prior art for the same volume as exemplified by a Bordeaux barrel.

#### BRIEF DESCRIPTION OF THE DRAWINGS

- [016] The invention will be more clearly understood and appreciated from the following description when read in conjunction with the accompanying drawings in which:
- [017] Figure 1 is a sectional view of a conventional Bordeaux barrel with semi-permeable tubes in accordance with one embodiment of the present invention.
- [018] Figure 2 is a top view of the barrel shown in Figure 1.
- [019] Figure 3 shows a sectional view of a food-grade container with semi-permeable tubes in accordance with another embodiment of the present invention.
- [020] Figure 4 is a sectional view of an embodiment of the invention in which the wine is contained in hollow permeable tubes.
- [021] Figure 5 is an end view of the container of Figure 4.
- [022] Figure 6 shows another embodiment of the invention showing a container employing flexible hollow semi-permeable tubes.
- [023] Figure 7 is an end view of the container of Figure 6.
- [024] Figure 8 is a sectional view of a container employing spaced plates providing air passages.
- [025] Figure 9 is an elevational view of the container of Figure 8.
- [026] Figure 10 is a sectional view of a mass transfer reactor including tubes for providing an air-permeable interface to flowing wine.
- [027] Figure 11 is a sectional view of a transfer reactor similar in configuration to the container of Figure 4 in which the wine flows through the semi-permeable tubes.
- [028] Figure 12 is an embodiment of the container of Figure 6 in which the wine flows through the semi-permeable tubes.
- [029] Figures 13 and 14 show an embodiment of the container of Figures 8 and 9 in which the wine flows through the apparatus.

wine. Commercial materials range from well-known Gore-Tex to sintered ceramics used for oxygen analysis.

[033] When oxygen is introduced into the wine volume as in the permeable tube design, it is possible to replace the wooden barrel with a container of non-porous material such as stainless steel or food grade plastic. This is illustrated by the container 18, Figure 3, with the semi-permeable tubes 19 secured to and sealed to the end walls 21 and 22. The cost of the container is reduced compared to a staved barrel, and the area for the aging reaction is increased.

[034] If, as in much of the present wine production, oak flavor needs to be introduced, it may be introduced by placing wood pieces or chips into the wine with the air-permeable walls being made of material other than oak.

[035] Figures 4 and 5 show a preferred embodiment which is an inverse arrangement to that of Figure 3. The wine is retained in a vessel or container 23 defined by two end sections 26 and 27 and semi-permeable tubes 28. The wine may be topped for volume decreases due to diffusion of alcohol and water vapor through the semi-permeable walls to the atmosphere by removing the stopper 29 and adding more wine. It is of course apparent that the shape of the end sections may be rectangular rather than round as shown in the figures.

[036] Figures 6 and 7 show an arrangement where the headers 31 and 32 are in the form of hollow rings interconnected by air-permeable flexible tubes 33 which together contain the wine. Air can travel through the opening 34 in the headers or can be arranged to flow transverse to the tubes.

[037] Figures 8 and 9 show an arrangement in which the wine and the air are separated by air-permeable plates 36. More specifically, the arrangement includes headers 37 and 38 which communicate with each other through the space between the permeable walls 36. The permeable walls are interconnected to form air passages 39 through which air flows. The walls provide the desired interface.

[038] Figure 10 is a version of a shell-and-tube mass transfer reactor which shows wine traveling through the container 41 and air traveling through one or more air-permeable tubes 42. Wine flows slowly through the reactor to provide the desired aging time.

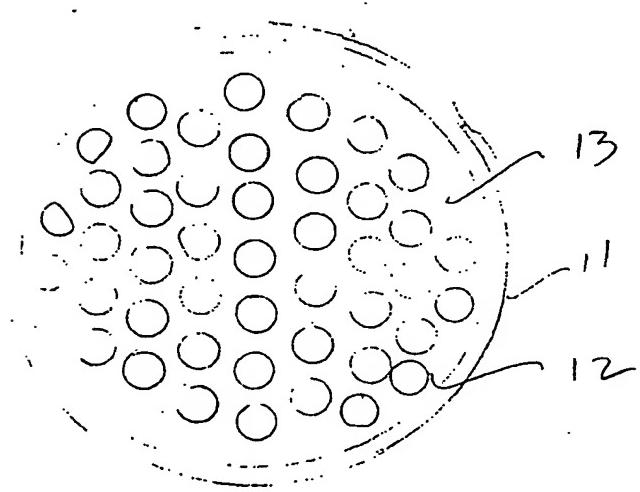
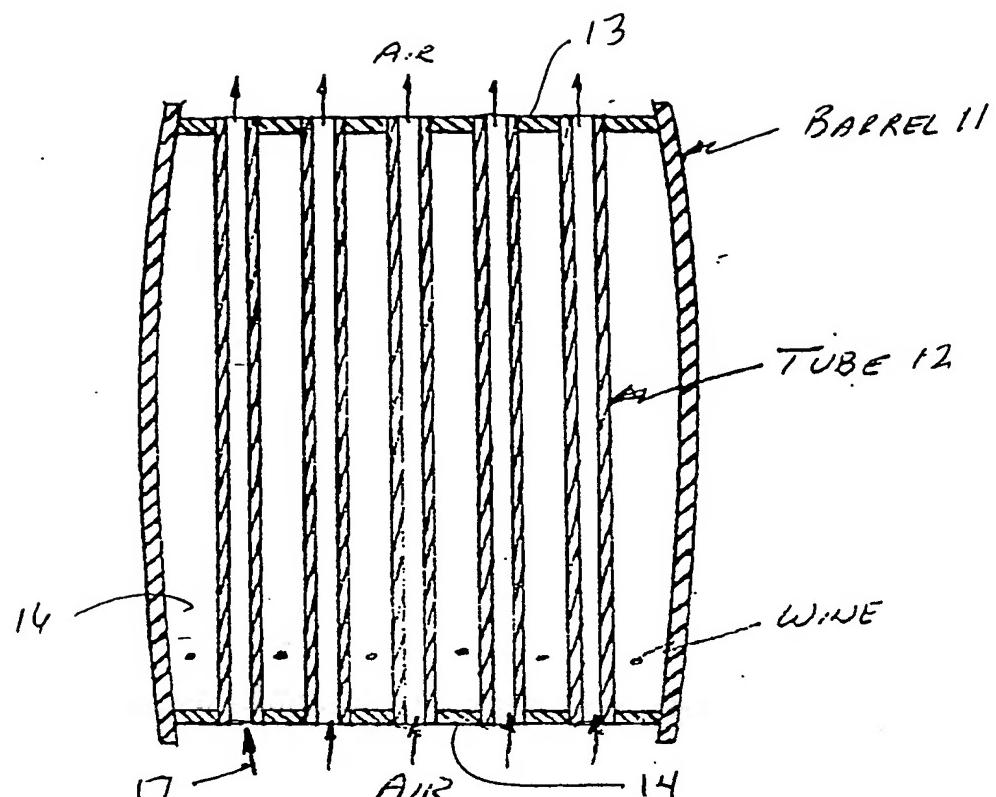
[039] Figure 11 illustrates a version of Figures 4 and 5 in which the wine is caused to slowly flow through the air-permeable tubes 28 which connect the spaced headers 26 and 27.

[040] Figure 12 shows a version similar to that of Figures 6 and 7 in which the wine is caused to slowly flow through the tubes 33 from header 31 to header 32.

[041] Figures 13 and 14 illustrate a cross-flow arrangement in the container of Figures 8 and 9 in which the wine is caused to flow slowly through the passages.

CLAIMS:

1. A container for wine or spirits comprising semi-permeable walls disposed between the wine or spirits and the surrounding atmosphere whereby oxygen from the atmosphere infuses through the walls to the wine interface to interact with and age the wine characterized in that,  
the ratio of the interface area to volume of wine is increased more than fifty percent as compared to the prior art ratio of interface area to wine provided by oak barrels.
2. A container as in claim 1 in which the container comprises a vessel and a plurality of hollow semi-permeable tubes extend through said vessel with their interior surfaces communicating with a source of oxygen.
3. A container as in claim 2 in which the container is an oak barrel.
4. A container as in claim 2 in which the container is made of food-grade material.
5. A container as in claims 1, 2 or 3 including means for causing the wine to move past the walls.
6. A container for wines or spirits comprising semi-permeable or impermeable spaced headers and a plurality of spaced semi-permeable tubes or spaces formed by plates extending between said headers, said headers and tubes or spaces containing the wine or spirits and said headers and tubes providing an interface with a source of oxygen whereby oxygen can infuse therethrough to interact with the contained wine or spirits.
7. A container as in claim 6 in which the tubes are flexible.
8. An apparatus for aging wine comprising:  
semi-permeable or impermeable headers and a plurality of spaced semi-permeable tubes or spaces formed by plates extending between and providing communication between the headers,



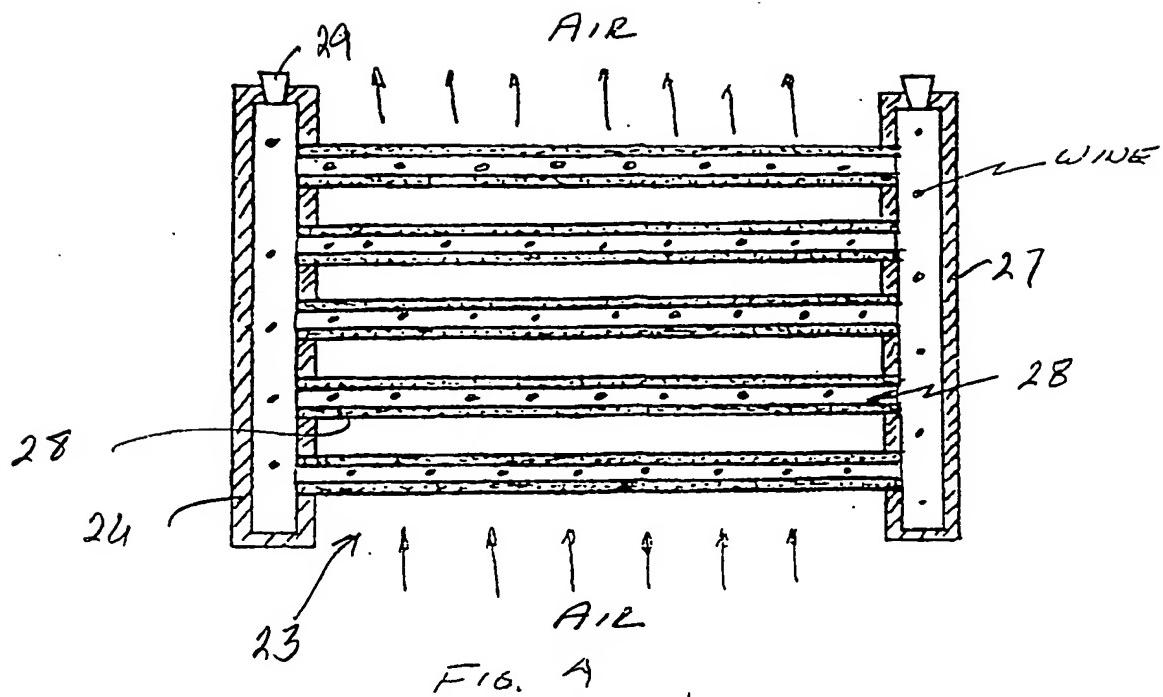


FIG. A

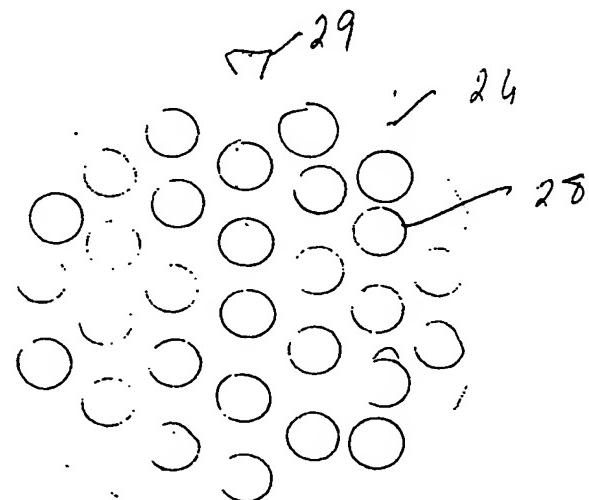
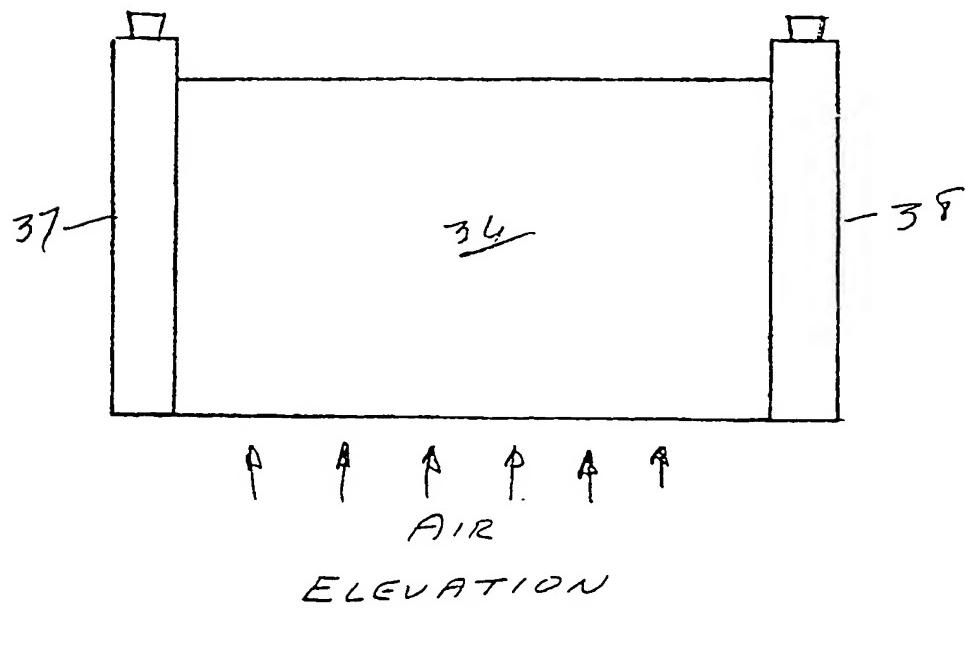
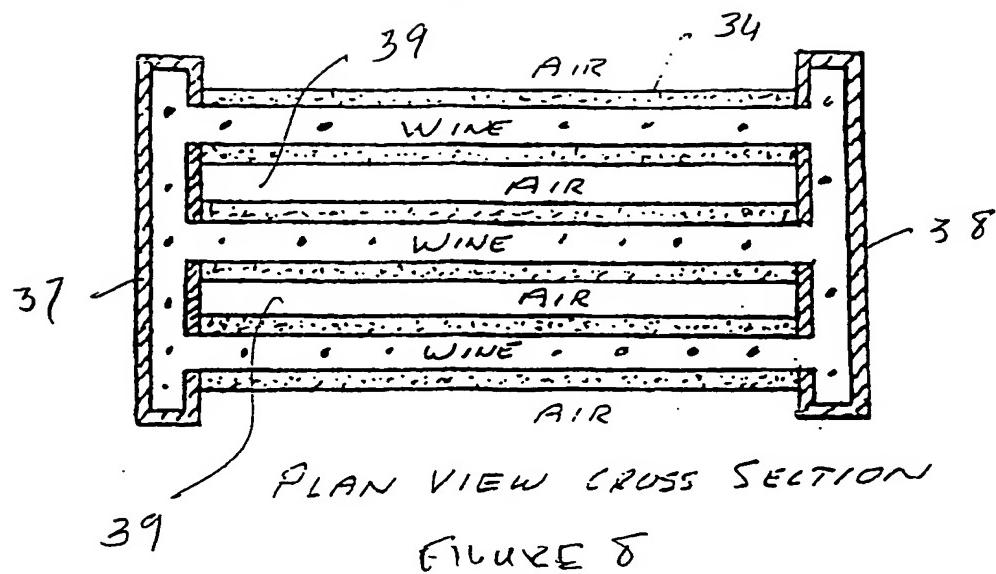


FIGURE 5

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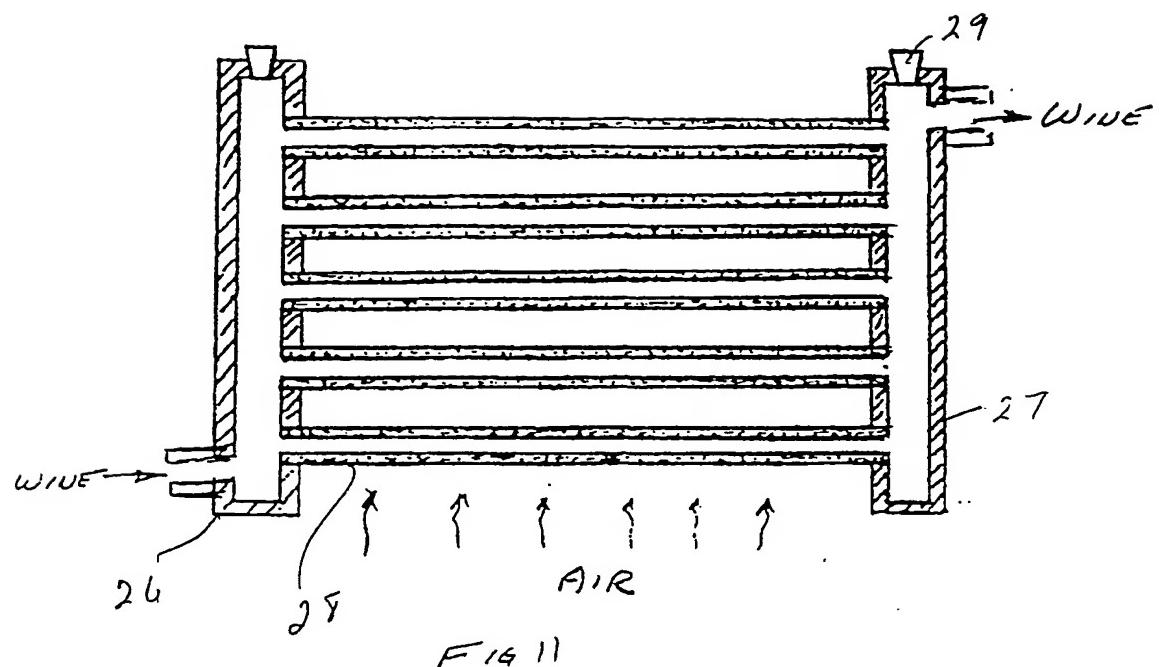


FIG 11

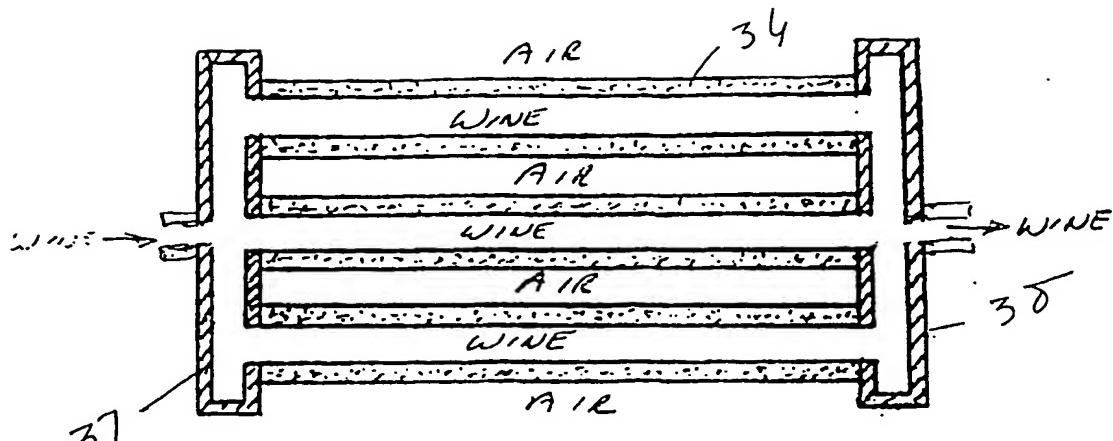


FIGURE 13

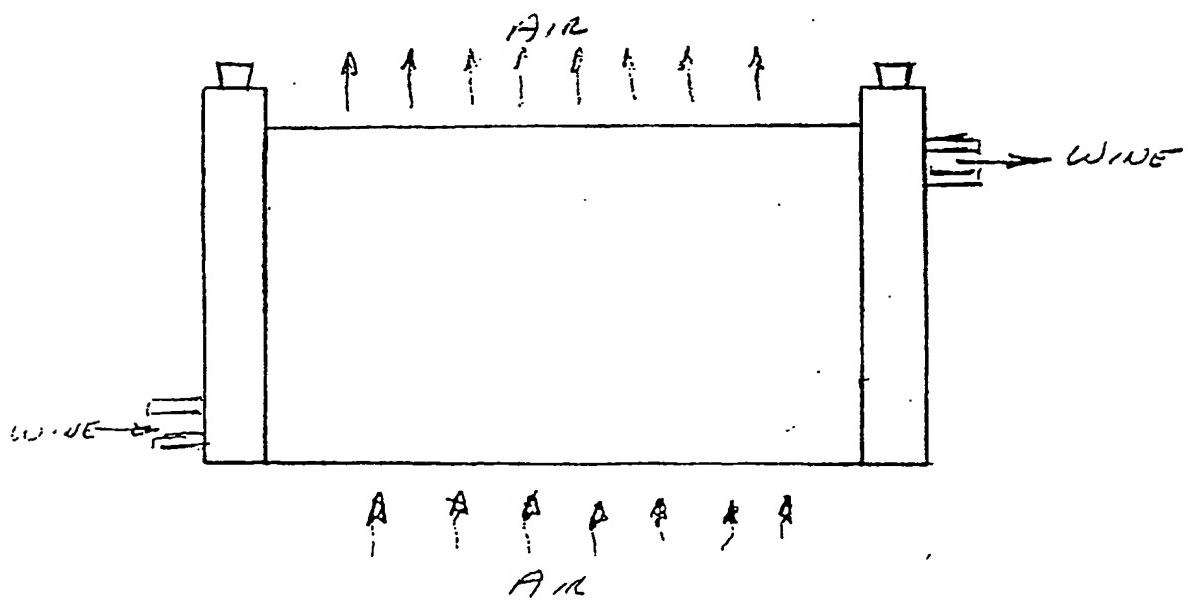


FIG. 14

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